DIVISION 4
WATER SYSTEMS

4.1 Design Criteria

The following design criteria shall govern the design of water distribution and transmission facilities. The intent of these criteria is to promote water system designs that will provide safe, adequate, and dependable water service without excessive maintenance costs. All water systems shall comply with the requirements of this manual, American Water Works Association standards, the "Recommended Standards for Water Works," Appendix E Backflow Control and Appendix F Water Facilities from Title 20, and NAC 445A.

Improvement plans for water systems and facilities must be reviewed and approved by the Nevada Division of Environmental Protection (NDEP) Bureau of Safe Drinking Water (BSDW), the Engineering Division **and** the local entity which will accept and maintain the improvements. Private water systems providing service to 25 or more residents must also receive approval from the Public Utilities Commission. Refer to Division 2 Improvement Plans for water system improvement plan requirements.

4.1.1 Water Supply Pressure

Minimum residual pressure in the distribution system shall be 20 psi at ground level for all service connections during all conditions of fire flow experienced during maximum day demand, 30 psi during peak hour demand, and 40 psi during maximum day demand. Static pressures shall not exceed 100 psi. Normally the use of booster pumps to increase pressures in localized areas will not be allowed. Review of the use of booster pumps in localized areas will include, but not be limited to, analysis of the 20-year life cycle costs (including operation and maintenance costs).

4.1.2 Water Demand Rates

For design of water systems, system capacity shall be based on Table 4.1.

Table 4.1
Source Water and Treatment Production Capacity per Residential Equivalent.

Service Area Demand (Residential Equivalents)	Metered System (gpm)	Unmetered System (gpm)
0 - 100	2.0	2.5
101 - 250	1.5	2.0
251 - 500	1.2	1.7
501+	1.0	1.5

4.1.3 Required Fire Flow

Fire flow shall be as required by the fire authority having jurisdiction. Minimum fire flow shall be 1,500 gpm within the Lake Tahoe Basin, and 1,000 gpm elsewhere, for a 2-hour duration with a minimum residual pressure of 20 psi at any point in the distribution system. Calculations to determine the residual pressure shall assume the maximum day demand is occurring during the fire flow. Pumps on underground wells shall not be used to provide required fire demand or fire flow.

4.1.4 Maximum Velocities

Sizing of distribution and transmission mains shall be such that water velocity meets the minimum requirements of NAC 445A.

4.2 Preliminary Engineering Report

A Preliminary Engineering Report (PER), prepared in accordance with Rural Utility Service (RUS) Bulletin 1780-02 (refer to Douglas County Public Works website for RUS Bulletin), shall be submitted to the County for all County-owned water systems. This report shall consider population, environmental, operation, maintenance, and financial impacts the proposed improvements will have. A water model shall be completed as part of the PER. The existing County water model may be provided to the consulting engineer at no cost. The water model shall be accepted "as is" and its accuracy verified by the design engineer.

The engineering consultant is responsible for completing hydraulic modeling on distribution/transmission lines, pumping facilities, storage tanks, and system appurtenances to evaluate the performance of the proposed facilities and their impact on existing County facilities. The proposed improvements shall be incorporated into the existing system model and shall provide the following information/scenarios:

1. Extended period simulation during Average Day Demand
2. Extended period simulation during peak demand
3. Fire flow simulation for the worst case scenario in the most critical areas of the system
4. A tabulation of water system pressures for all simulations, including pressure contour maps
5. Extended period and fire flow simulations for the proposed system at master plan build-out
6. Water quality and water age analysis during average day demand

The engineering consultant shall provide the County a copy of the updated hydraulic model in the most recent version of Bentley WaterCAD or EPANet. All modeled scenarios shall be included in a single model. The engineering consultant shall also produce a modeling report that outlines the methods and assumption used to develop the model, including, but not limited to:

1. Source and accuracy of elevation data
2. Scaling methods
3. Demand distribution
4. Fire requirements, including documentation from the applicable fire authority
5. Pump curves
6. Proposed control logic
7. Other, as required or requested

The modeling report shall also include a summary of model results. Douglas County Public Utilities Department will review the model and the modeling report to verify data accuracy, review the proposed improvements impact on existing infrastructure and operations, and evaluate the proposed improvements compatibility with existing planning and capital improvements. Douglas County Public Utilities Department will produce a model approval letter or summary of required changes or modifications to the proposed improvements to bring the improvements into compliance with existing County operations/performance standards and infrastructure planning. As part of this review, Douglas County will not provide comment or verification regarding compliance with NAC 445A or NDEP req`uirements.

4.4 Water Rights

The quantity of water rights must be sufficient to meet the demand of the project. Water right dedication amounts as required by the Douglas County Development Code are minimum requirements; refer to Code Section 20.100.040. The applicant or the applicant's engineer shall confirm the water rights required to meet the project demand through a technical analysis approved by the Public Works Department or the applicable water purveyor.

4.5 Distribution Mains Size and Material

Distribution mains shall be sized to deliver required flows at the pressures specified in Section 4.1.1 Water Supply Pressure. Minimum size for network piping (distribution and transmission mains) shall be 8 inches in diameter, unless approved otherwise by NDEP and/or water purveyor. All mains shall be looped and networked, with the exception of mains that serve cul-de-sacs, to provide alternate flow routes

Distribution main pipe shall be either ductile iron pipe (DIP) or PVC. DIP shall be designed in accordance with AWWA C150 and shall be manufactured in accordance with AWWA C151. DIP shall be cement mortar lined and seal coated in accordance with C104. The distribution main may be polyvinyl chloride (PVC) in conformance with AWWA C900 Standard for Polyvinyl Chloride (PVC) Pressure Pipe, 4 Inches through 12 Inches or AWWA C905 for Polyvinyl Chloride (PVC) Pressure Pipe, 14 Inches through 48 Inches. If ductile iron pipe is used, a soil analysis and corrosion study shall be submitted with the water system improvement plans and provide recommendations for protection from corrosion by polyethylene encasement.

The distribution main shall be pressure rated for the maximum working pressure which includes surge pressures resulting from an instantaneous valve closure. Minimum ratings for the pipe shall be Pressure Class 350 for DI pipe less than 16 inches in diameter and Class 250 for DI pipe 16 inches and greater, and Class 235 DR 18 for PVC pipe. Ductile iron pipe and fittings shall be protected from corrosion by polyethylene encasement in conformance with ANSI/AWWA C 105/ A.21.5-05 American National Standard for Polyethylene Encasement for Ductile Iron Piping for Water and Other Liquids as recommended by a soil analysis and corrosion study. Seismic design shall be incorporated in all areas where the transmission main crosses a fault.

4.5.1 Distribution Main Bedding

Class A backfill used as bedding shall be in conformance with Subsection 200.03.02 of the Standard Specifications for Public Works Construction. Bedding material shall be brought up in 4 inch lifts to 12 inches above the crown of pipe. In wet trenches, cutoff walls (water stops) shall be constructed to prevent the piping of water in the bedding material. The native soil conditions shall be evaluated to determine if a filter fabric wrap of the bedding material is needed to prevent migration of native soils into the bedding material. The design of the cutoff walls (water stops) shall be submitted to the Engineering Division with the improvement plans. Each lift shall be compacted by an approved method. Typical trench sections shall be as shown in the Standard Details.

4.5.2 Main Location

All water mains shall be installed in public rights-of-way or public easements. Minimum easement widths shall be as required in Section 9.2 Easement Size. Minimum cover over a water main at all locations shall be 42 inches. Minimum cover shall be the distance from the top of the water main to finished grade. Location of water mains in public rights-of-way shall conform to the Standard Details. Designs shall minimize the use of high points by maintaining positive slopes; this may require that water mains are installed deeper than minimum cover requirements.

4.5.3 Utility Clearances

Sanitary sewers shall be located to minimize potential contamination and disturbance of water supply. Additional requirements may be imposed by the local utility companies, and the Nevada Division of Environmental Protection, Bureau of Safe Drinking Water. See NAC 445A. **Concrete or cement slurry encasement of the sewer main or water main will not be allowed in lieu of required clearances.**

4.5.4 Stream and Ditch Crossings

Crossing details of pipe, piers, anchorage, transition coupling, etc. shall be shown on the improvement drawings. Crossings shall be per NDEP Bureau of Safe Drinking Water Requirements. Ductile iron pipe with restrained joints shall be used under the full stream or ditch width, and 10 feet on each side. All stream, irrigation ditches, and ditch crossings shall have a minimum clearance of 5 feet between the stream bottom and top of pipe, and shall be enclosed in a pipe sleeve, or covered with a concrete cap. Consideration shall also be given to protecting the pipe during stream flooding and scour. A scour analysis shall be provided as required by the Engineering Division. Stream crossing and construction methods shall be approved by the appropriate agency (Nevada Division of Environmental Protection, Nevada Department of Fish and Game, Nevada State Lands, Water Conveyance Advisory Committee, and the Corps of Engineers). See NAC 445A.

4.5.5 Valves

Valves in commercial and industrial areas shall be located in such a manner that water main lengths of not more than 500 feet can be isolated by valve closures. Valves in all other areas shall be located in such a manner that water main lengths of not more than 800 feet can be isolated by valve closures, unless a shorter length is required by the reviewing agency. There shall be three valves at every tee and four valves at every cross fitting. Valves 12 inch and smaller shall be resilient-seated gate valves. Valves larger than 12 inch shall be butterfly valves, or as approved by water authority. Valves shall be in conformance with AWWA C509 Standard for Resilient-Seated Gate Valves, for Water and Sewerage Systems and AWWA C504 Standard for Rubber Seated Butterfly Valves. Provide and install extension stems so that the valve operating nut is not greater than 3 feet below finished grade. Valve boxes and covers shall be rated for H-20 traffic and installed in accordance with the Standard Details. Valves shall have a minimum of 24 inches of cover over the operating nut. Valve boxes shall not be installed in ditches.

4.5.6 Fire Hydrants

In all areas where fire hydrants are required along roadways, the spacing between adjacent hydrants shall be determined by the appropriate fire authority, but shall not exceed 500 feet in residential areas and 300 feet in institutional, commercial, and industrial areas. The spacing between adjacent fire hydrants in areas and locations other than along roadways shall be determined by the appropriate fire authority.

Hydrant spacing shall be measured along the shortest route within the traveled way of streets which connect the hydrants. Wherever possible, hydrants shall be located at street intersections. All other hydrants along roadways shall be located at the intersection of property lines and street right-of-way boundaries. Fire hydrants shall be installed in accordance with the Standard Details. No portion of the fire hydrant shall be located within the sidewalk or roadside ditch. Bollards shall be installed around all fire hydrants that are not protected by curb and gutter and in all commercial and industrial areas whether or not curb and gutter is present.

The hydrant lateral which interconnects the pipeline and the hydrant shall be not less than 6 inches in diameter. A maximum length of 150 feet of 6 inch lateral serving a fire hydrant from a single source shall be allowed. A larger size water main shall be required for any distance greater than 150 feet. A 6 inch gate valve shall be installed in all hydrant laterals. Water service or fire service connections are not allowed on fire hydrant laterals. The type or style and location of fire hydrants shall be determined by the County, town, fire department, or general improvement district as appropriate: however, all fire hydrants shall be freeze-proof dry barrel hydrants.

4.5.7 Services

Water services shall be located per the standard detail titled "Typical Utility Laterals Locations, A16." Water service connections shall be installed at right angles to a water main and the point of connection shall not be within a street intersection. The size of the water service from the water main to the meter box shall be equal to the size of the water meter. Water service connections to private water lines **are not** allowed. All services shall be equipped to allow for installation of a water meter. Minimum residential service line size shall be ¾ inch for service to a single meter and 1 inch to double meter services.

The meter box shall be located within the public right-of-way or easement adjacent to an existing or proposed curb line. In alleys or easements, meter boxes shall be located at a point as close as practicable to the property line near which the water main is located. All meter boxes shall be located outside of driveways, driving surfaces, and other areas where access for operation and maintenance may be restricted. Whenever possible, double meter boxes shall be located on residential property lines between lots with a single service line from the water main to the meter box.

Each commercial building shall have a separate water service connection at the public water main and a separate meter. Commercial irrigation lines shall have separate connection at the public water main and a separate meter. Fire service lines shall have a connection at the public water main, separate from the domestic and irrigation connections.

Meter boxes shall be as approved by water utlity. Service lines shall be polyethylene pipe or copper tubing. Water meters shall be ¾ inch (for residential services on County water systems, or the size required by the reviewing agency for other water systems). Douglas County will provide direction on the specific brand and model of water meter that will be acceptable for use. Water service connections shall be installed in accordance with the Standard Details.

4.5.8 Locating Tape

All buried, nonmetallic transmission, distribution and service pipes shall have a locating wire and a locating tape. The locating wire shall be installed and secured to the pipe, and the locating tape shall be installed on top of the pipe bedding envelope. The locating tape shall bear a continuous message "Caution - Water Line Buried Below" or words of similar nature. The ends of the locating wire shall be accessible and extend into all valve boxes or other underground vaults. The locating wire shall be a minimum 12 gauge copper-clad steel wire with HDPE coating.

4.5.9 Permits

The improvement plans shall clearly indicate that all work in rights-of-way requires a County site improvement or encroachment permit.

4.5.10 Blowoffs (Flush Valves)

Fire hydrants shall be used as blowoffs for in-line low points and all dead ends. Temporary blowoffs shall be provided as necessary to pressure test and chlorinate the water mains. Temporary blowoffs shall be removed upon acceptance of the water line.

4.5.11 Air and Vacuum Valves and Air-Release Valves

Air and vacuum valves and air-release valves shall be installed at all high points in the water mains and where required by the Engineering Division. Air and vacuum valves and air-release valves shall be installed in accordance with the Standard Details. Air and vacuum valves and air-release valves shall be tested and approved in accordance with AWWA C512 Standard for Air-Release, Air/Vacuum, and Combination Air Valves for Water Works Service.

4.5.12 Pressure Reducing Valves

Pressure reducing valves shall be provided on distribution mains as necessary so that the system pressure will not exceed 100 psi static pressure at the lowest ground elevation of a pressure zone. Pressure reducing valves shall be installed in concrete vaults. Concrete vaults shall be rated for H-20 traffic. The vault entrance hatch shall be similar to Bilco type rated for H20 loading and constructed out of aluminum and secured to the vault structure. Entrance hatches constructed out of steel, that use torsion bars, or that are not designed to minimize water entry into the vault are not acceptable. The cover shall lock securely in the open position and shall have a locking mechanism suitable for a padlock.

The size of the concrete vault shall be adequate to allow access to the pressure reducing valve for maintenance. Pressure reducing valves are preferred to be located outside of the traveled way. Concrete vaults shall not be located within a sidewalk or driveway. The installation shall provide for minimum clearance of 24 inches from the inside walls and 18 inches to the floor of the concrete vault to valves or piping. The installation shall include bypass piping and valving, and isolation valves to allow removal of the pressure reducing valve without utilizing additional valves outside of the concrete vault.

4.5.13 Cross Connection

The term "cross-connection" shall mean any unprotected actual or potential connection, auxiliary intake, bypass, or other piping arrangement between a public water supply and any other source through which it is possible to introduce by backsiphonage and/or backpressure any used water, industrial fluid, gas, or other substance from a source which does not comply with the Primary or Secondary Drinking Water Standards. Unprotected cross-connections with the public water supply are prohibited.

An approved backflow prevention assembly shall be installed on each service line to a customer's water system at or near the property line or immediately inside the building being served; but, in all cases, before the first branch line leading off the service line wherever the following conditions exist:

1. In the case of premises having an auxiliary water supply which is not or may not be of safe bacteriological or chemical quality and which is not acceptable as an additional source by the County, the public water system shall be protected against backflow from the premises by installing an approved backflow prevention assembly in the service line appropriate to the degree of hazard.
2. In the case of premises on which industrial fluids or other objectionable substances are handled in such a fashion as to create an actual or potential hazard to the public water system, the public system shall be protected against backflow from the premises by installing an approved backflow prevention assembly in the service line appropriate to the degree of hazard.
3. In the case of premises having (1) internal cross-connection that cannot be permanently corrected or controlled, or (2) intricate plumbing and piping arrangements or where entry to all portions of the premises is not readily accessible for inspection purposes, making it impracticable or impossible to ascertain whether or not dangerous cross-connections exist, the public water system shall be protected against backflow from the premises by installing an approved backflow prevention assembly in the service line.

4.5.14 Backflow Prevention Devices

Each water service connection shall have an assembly for the prevention of backflow, of a type that is commensurate with the degree of hazard that exists on the property of the customer of a public water system. The type of protective assembly required under this section shall depend upon the degree of

hazard that exists. The County reserves the right to install a more stringent device than listed if; in the County's sole judgment the particular circumstances require a higher degree of backflow prevention. All backflow prevention devices shall meet the requirements of NAC 445A and the American Backflow Prevention Association regulations at a minimum in addition to following requirements.

4.5.14.1 Vacuum Breakers

An atmospheric vacuum breaker or pressure vacuum breaker shall be used only for protection against pollution or contamination under conditions of backsiphonage. Vacuum breakers (AVB, PVB, or SVB) may be used for irrigation systems, including systems for irrigation of median strips.

4.5.14.2 Spill Resistant Pressure Vacuum Breaker (SVB)

A spill resistant pressure vacuum breaker is an assembly that contains an independently operating loaded air inlet valve located on the discharge side of the check valve. The following conditions must be met for SVB installations:

1. The SVB shall be installed upstream from the terminal shutoff valve.
2. The SVB must be installed not less than 12 vertical inches above the highest point of the downstream outlet, valve or piping.
3. The SVB must not be installed at a location where backpressure will occur

4.5.15 Assembly Requirements

Backflow prevention assemblies required herein shall be a make, model and size approved by the Public Works Department or applicable water purveyor. An approved backflow prevention assembly shall mean an assembly that has been manufactured in full conformance with AWWA C510 Standard for Double Check Valve Backflow-Prevention Assembly, and AWWA C511 Standard for Reduced-Pressure Principle Backflow-Prevention Assembly, and have met completely the laboratory and field performance specifications of the Foundation for Cross-Connection Control and Hydraulic Research of the University of Southern California (USC FCCCHR), as established in: "Specifications of Backflow Prevention Assemblies - Section 10 of the current edition of the Manual of Cross-Connection Control."

4.5.16 Testing Requirements

It shall be the responsibility of the customer at the premise where backflow prevention assemblies are installed to have certified inspections and operational tests made at the customer's sole expense at least once per year. In those instances where the Public Works Department deems the hazard to be great enough, certified inspections may be required at more frequent intervals. These inspections and tests shall be performed by a tester certified by the American Water Works Association, California-Nevada Section. The customer shall notify the Public Works Department two (2) working days in advance when the tests are to be undertaken so that aPublic Works Department representative may witness the tests.

A test report in a form acceptable to the County shall be filed with the County Public Works Department upon installation and each time a backflow prevention device is repaired, relocated, or replaced. Approval from the County must be obtained before a backflow prevention device is removed, relocated, repaired, or replaced.

4.5.17 Installation Requirements

Backflow devices shall be installed as per NAC 445A, and as shown in the standard details. The County or applicable water purveyor shall have the final authority in determining the required location of a backflow prevention device.

4.5.18 Disinfection and Testing

All water mains shall be disinfected and tested in accordance with AWWA C651 Standard for Disinfecting Water Mains. All water mains shall be pressure tested at 150 percent of the pipe pressure class or a minimum of 150 pounds per square inch, whichever is greater, in accordance with the "Standard Specifications for Public Works Construction."

4.5.19 Length of Open Trench in Street Areas

No trench shall be left open or uncovered overnight in a developed area. In undeveloped areas, no trench shall be opened more than three hundred (300) linear feet in advance of where backfilling and surfacing have been completed. Surfacing shall mean crushed stone trench topping and may mean temporary or permanent asphalt concrete resurfacing, if required. All surfacing requirements shall conform to applicable County requirements. If the work is delayed on the whole, or part of the project, and excavations are left open for more than three (3) consecutive days, then the contractor shall backfill the excavations and temporarily repave over the excavation area, the trench shall not be opened until the contractor is ready to proceed with the work. If the contractor neglects or fails to completely refill excavations and temporarily repave over the excavation within twenty-four (24) hours after notice to do so, then the County shall be authorized to temporarily surface the excavations and the costs shall be charged to the contractor. The contractor shall at all times provide for public access by permitting traffic to pass through the construction area. All driveways are to remain passable between the hours of 4:00 p.m. and 8:00 a.m. throughout construction.

4.5.20 Dewatering

Dewatering, sufficient to maintain the groundwater level at or below the surface of the trench bottom or base of the bedding course, shall be accomplished prior to pipe laying and jointing of water pipe. The dewatering operation shall be carried out so that it does not destroy or weaken the strength of the soil under or alongside the trench. The normal water table shall be restored to its natural level in such a manner as to not disturb the pipe and its foundation.

Water pumped from excavations shall be disposed of by the contractor in such a manner as will not cause injury to public or private property or constitute a nuisance or menace to the public. At all times, the manner employed to discharge and to dispose of water pumped from an excavation shall be subject to the approval of the County and the appropriate permitting agency (i.e. Nevada Division of Environmental Protection - Bureau of Water Pollution Control, U.S. Army Corps of Engineers, Nevada State Lands, Division of Water Resources). All surface waters shall be prevented from entering open ditches or excavations by proper grading of the ground surface in the vicinity of the excavation.

4.5.21 Pipeline Installation

All pipe (mains) shall be laid true to line and grade as shown on the approved plans. The underground installation of all distribution mains shall be in accordance with manufacturer's recommendations and the requirements of Division 4, and the "Standard Specifications for Public Works Construction."

4.5.22 Location and Alignment

All water distribution mains shall be placed within right-of-way dedicated for public streets unless the use of easements is approved by the Engineering Division. Horizontal and vertical clearances shall comply with the requirements of Section **4.5.3** Utility Clearances. The location of distribution mains in public rights of way shall conform to the Standard Details.

When distribution mains are to be installed in existing streets, factors such as curbs, gutters, drainage ditches, sidewalks, traffic conditions, pavement conditions, future street improvement plans, and existing utilities shall be considered by the design engineer when selecting the main location and alignment.

The minimum width of easements shall be twenty (20) feet. Other factors such as side slopes and structures within the easement may require additional width. If a main is installed within an easement, temporary maintenance access with a minimum width of 12 feet may be required in accordance with Section 3.10.14 Improved Maintenance Access. Permanent maintenance access in accordance with the requirements of Section 3.10.14 Improved Maintenance Access may be required by the County or water purveyor.

4.6 Water Supply Wells

4.6.1 General

This section covers the requirements for public water supply wells on Douglas County maintained systems. Because a development requires a water source of sufficient quality and quantity, the Public Works Department may require completion of the water supply wells prior to approval of a final map. The developer shall be responsible to notify the Public Works Department prior to initiating well drilling or testing activities. The purpose of this notification is to ensure that the well is constructed and tested in a manner acceptable to the County. The County Engineer shall have the final decision as to acceptability of the well for dedication to the County.

A permit issued by the State Engineer pursuant to NRS chapters 533 and 534, must be obtained prior to initiating drilling of a water supply well. All drilling must be performed by a Nevada licensed water well driller.

4.6.2 Design Criteria

Design criteria for water supply wells are presented in the sections that follow.

4.6.2.1 Location

No well shall be located within 50 feet of gravity sanitary or storm sewers. No well shall be located within 150 feet of a sewer force main, sewer lift station, septic tank, absorption field, designated septic absorption replacement field location or other source of pollution or contamination.

4.6.2.2 Well Capacity Criterion

There shall be sufficient water from all sources to meet the maximum day demand. The flow rate for this criterion shall be the amount of water that can be delivered to the system while all water sources are being pumped to the system, not the sum of the discharge capacities of the individual wells when being pumped alone. Additionally, the total water system capacity from all facilities shall be sufficient to meet the greater of the following:

1. the maximum day demand, fire flow and fire demand when all facilities of the system are functioning; or
2. the average day demand, fire flow and fire demand when the most productive well of the system is not functioning

A minimum of two producing wells shall be provided, unless the system is physically connected to another independent municipal water system, and an interlocal contract is in place for provision of water in the event of emergencies.

4.6.2.3 Water Quality

The water from the sources shall meet the Nevada State Drinking Water Regulations with respect to microbiological, physical, chemical and radiological qualities as adopted in Nevada Administrative Code, Chapter 445, Public Water Systems - Quality. Point of entry or point of use treatment devices shall not be used on public water systems. Blending of more than one source shall not be allowed as a means to comply with the water quality requirements. Each source alone shall comply with the water quality requirements.

4.6.2.4 Standards

The following standards shall be used in the logging, test pumping, abandonment, design and construction of wells:

1. State of Nevada Division of Water Resources, Regulations for Drilling Water Wells.
2. AWWA A100 Standard for Water Wells.
3. The State Engineer's permit under which the well is to be drilled.
4. NAC 445A

4.6.2.5 Casing

Casing size shall be suitable for installing a pump, a 1 inch sounding tube and a ¼ inch air line. Material shall be suitable for placement in formation encountered. Chemical and conductivity analysis of the formation and water shall be determined via a test hole and submitted to the Engineering Division as proof of suitability. The casing material shall be approved by the Public Works Department prior to setting the casing; stainless steel casing shall be used in all waters that are deemed corrosive. The casing thickness shall conform to State of Nevada, Division of Water Resources, Regulations for Drilling Water Wells and AWWA A100.

4.6.2.6 Well Screen

Well screen may be of continuous wire wrap design, shuttered screen, louvered screen, or bar lug screen as approved by the Public Works Department; stainless steel screen shall be used in all waters that are deemed corrosive. Screen opening shall be based on gravel pack sieve analysis and formation sieve analysis. A licensed engineer shall stamp and submit sieve analysis and recommended screen opening size to the Public Works Department for approval a minimum of two (2) working days in advance of well screen installation. A hydrogeologist, approved by the Public Works Department, with demonstrated professional experience in hydrogeology, well design and well construction may also submit the sieve analysis and recommended screen opening size.

4.6.2.7 Gravel Pack

All new wells shall include a gravel pack. The minimum gravel pack thickness shall be 4-inches between the wall of the drill hole and the casing. A licensed engineer shall stamp and submit the recommended gravel source and gradation to the Public Works Department for approval a minimum of two (2) working days in advance of gravel pack installation. A hydrogeologist, approved by the Public Works Department, with demonstrated professional experience in hydrogeology, well design and well construction may also submit the recommended gravel pack and gradation.

The gravel pack shall be placed by reverse circulation method, or by a tremie pipe, raising the tremie pipe as the gravel pack is placed. All new wells shall also include a gravel fill tube.

4.6.2.8 Drilling Method and Borehole Geophysical Logs

Direct or reverse circulation drilling methods with drilling fluid (maximum Marsh viscosity 45 seconds) shall be used for well construction. All other methods shall be approved by the Public Works Department.

At a minimum, the following borehole geophysical logs shall be run on all boreholes prior to setting casing:

1. Spontaneous Potential Curve
2. Resistivity Log
3. Electric Log
4. Caliper Log

Additional logs as recommended by the engineer or hydrogeologist, or as required by the Public Works Department, shall be run.

4.6.2.9 Plumbness and Alignment

All wells shall be tested in accordance with AWWA A100. Contractor shall be subject to the requirements of AWWA A100 Section 8. The tolerance requirements shall apply from the top of the well to the bottom of the casing.

4.6.2.10 Test Pumping

All wells shall be tested for yield and drawdown prior to final pump selection. A licensed engineer shall stamp and submit test pump size and setting to the Public Works Department for approval a minimum of two (2) working days in advance of test pumping. A hydrogeologist, approved by the Public Works Department, with demonstrated professional experience in hydrogeology, well design and well construction may also submit the test pump information to the County.

4.6.2.11 Disinfection

All wells shall be disinfected in accordance with AWWA A100. Developer shall have water samples taken and analyzed by a State approved laboratory to verify disinfection. Lab test records shall be submitted to the Public Works Department as part of the well construction record report.

4.6.2.12 Grouting and Sealing

All wells shall be grouted and sealed in accordance with the referenced standards.

4.6.3 Hydrogeologic Evaluation and Improvement Drawings

A hydrogeologic evaluation shall be submitted for all wells. The evaluation shall be prepared by a licensed engineer or a hydrogeologist, approved by the Public Works Department, with demonstrated professional experience in hydrogeology, well design and well construction and shall contain, but not be limited to the following:

1. A detailed map showing well location (Such as a USGS 7-1/2 minute quadrangle map).
2. A summary of available hydrogeologic information including reports, logs of nearby wells, water quality data, and other relevant information.

3. A description of the proposed plan for exploration, testing and well construction. This shall include proposed drilling method, lithologic logging and sampling, other logs (temperature, resistivity, specific conductance, etc.), and sampling for water quality and yield.
4. A statement of anticipated water demand from the well.

Final wet stamped construction drawings, specifications, and design calculations for the well and appurtenant facilities shall also be submitted to the Public Works Department as part of improvement plans. Construction drawings and specifications shall include all appurtenant facilities such as but not limited to pumps, building, stand-by generator, and chlorination facilities.

4.6.4 Construction

All wells shall be constructed in accordance with:

1. State Engineer Requirements - Regulations for Drilling Water Wells
2. State of Nevada Bureau of Health Protection Services Requirements
3. AWWA A100 Standard for Water Wells

The Public Works Department may place additional requirements on the design and construction of the well based on site-specific conditions. Specific items which require approval of the Public Works Department prior to construction are:

1. Borehole diameter
2. Production casing diameter and material
3. Screen type, material and slot size
4. Gravel pack design
5. Drilling technique
6. Method for installing sanitary seal and gravel pack
7. Method for providing access for taking water level measurements in completed well
8. Pump chamber length and location

Geophysical logging, sieve analysis, plumbness, alignment, and other data are to be provided to the County prior to well construction for review. The County shall have 7 days to review the required data. Gravel pack design, screen slot size, and pump chamber length and location may be adjusted in the field by the engineer, hydrogeologist, or at the request of the County based on the results of geophysical logging, sieve analysis, and other data collected as part of the drilling process. Constructing the well prior to receiving County approval may result in County denial of the well, based on the County's discretion.

All well construction shall be done under the responsible oversight of a licensed engineer, or a hydrogeologist, approved by the Public Works Department, with demonstrated professional experience in hydrogeology, well design and well construction.

4.6.5 Development

Wells shall be developed by pumping, mechanical surging, backwashing or other means. Development shall continue until no increase in the specific capacity is achieved and the sand production rate is less than 5 parts per million within the first three to five minutes of the start of pumping as measured with a Rossum Sand Tester for the greatest anticipated pumping rate. The method for determining specific capacity and sand content shall be approved by the Public Works Department. The Public Works Department shall have the final determination as to when development is complete and the sand production rate is acceptable.

4.6.6 Yield and Efficiency Testing

Yield and efficiency testing shall be conducted under the direct observation (during the entire test) of an independent hydrogeologist or licensed engineer who has been approved by the Public Works Department. Efficiency testing shall include a 4-step efficiency test at pumping rates of 50%, 75%, 100%, and 125% of expected demand from the well. The duration of each step shall be a minimum of 100 minutes, followed by an equal time recovery period. Yield testing shall consist of a constant discharge pumping test at a rate equal to or greater than the expected demand from the well. Pumping duration shall be a minimum of 72 hours. If data collected during the 72 hours pumping indicate, in the opinion of the engineer, hydrogeologist or Public Works Department that a longer test is necessary, pumping shall continue until the safe long-term yield of the well can be determined to the satisfaction of the Public Works Department. For example, wells in fractured bedrock conditions may require constant rate yield tests of 10 or more days.

As part of the final improvement drawings and specifications, the hydrologist's or engineer's proposed testing plan shall be submitted to the Public Works Department for review and approval. The testing plan shall include, but not be limited to:

1. A description of the pump and driving mechanism to be used, with rated capacities.
2. A description of the method and apparatus to be used for flow rate monitoring.
3. A description of the method and apparatus to be used to measure water levels and drawdown (a 1 inch or larger diameter sounding tube will be required.)
4. A proposed time schedule for testing.
5. A plan for disposing of the water produced during the pump test.

4.6.7 Water Quality

Water samples shall be collected at the beginning and at 24-hour intervals during the yield testing (Four samples for a 72 hour test). The sample collected at the end of the test shall be analyzed to determine if the water is in conformance with Nevada State Drinking Water Regulations with respect to microbiological, physical, chemical and radiological qualities as adopted in Nevada Administrative Code, Chapter 445, Public Water Systems - Quality. Water temperature and electrical conductivity shall be monitored during the pump test.

4.6.8 Downhole Color Television Survey

After completion of the casing, sealing, and test pumping, and prior to installation of pumping equipment, a downhole color television survey shall be completed from the ground surface to the total depth of the well. The survey shall be conducted and recorded on a color DVD as a camera is lowered into the well. The camera shall be lowered in such a manner and speed as to allow a detailed examination of the casing

interior. The color DVD shall be provided to the Public Works Department as part of the Well Construction Record Report.

4.6.9 Well Construction Record Report

Where groundwater wells are constructed, a licensed engineer or a hydrogeologist, as approved by the Public Works Department, with demonstrated professional experience in hydrogeology, well design and well construction shall prepare and submit two (2) bound copies of a Well Construction Record Report containing the following information to the County prior to County acceptance or approval of the improvements:

1. A surveyed map showing the location of wells constructed.
2. A summary and recommendation report detailing the capacity and expected long-term drawdown effects (20 years) of each well constructed. The report shall include all pertinent comments related to aquifer hydraulic characteristics, sand production and water quality.
3. Descriptions and diagrams detailing materials, borehole diameters, surface seal dimensions, screened intervals, depths, static water levels and other pertinent aspects of the well construction.
4. A summary describing the drilling methods, name and address of drilling contractor, name and address of hydrogeologic consultant, and well development methods.
5. A summary report detailing the pumping test program. The report shall include a description of the test equipment, method of measuring discharge rates, method of measuring sand content, and a table outlining the type and duration of pumping tests performed.
6. A report detailing the methods of analysis used and the results of analysis of test pumping data. The report shall contain a description of well efficiency at the design production rate and the aquifer parameters determined from the constant discharge pumping test.
7. A report detailing water quality. The report shall describe sampling methods, and the results of water quality and bacteriological analysis.
8. Recommended equipping of the well including the following
    a. Pump and Motor
    b. Pump Building Enclosure
    c. Recommended Treatment and Treatment Equipment
    d. Recommended power (permanent and auxiliary/standby)
    e. Transmission Main, Pump to Waste and Necessary Land Rights
    f. Discussion on how the facility will operate with the system
    g. Recommendations for special building equipment such as security breach, high/low pressure, etc.
9. The submitted report shall contain appendices which shall include:
    a. Geologist's and Well Driller's logs
    b. Borehole Geophysical Logs
    c. Grain size distribution analysis of selected gravel pack

d. General materials documentation, including casing and screen invoices, gravel invoices, cement invoices

e. Required permits and logs

f. All pumping test data, including graphs and calculations

g. Water quality analysis report forms

h. Daily hydrologist's logs

i. Drawing of the completed well showing all the construction features of the well

10. Color DVD of well casing after grouting, sealing and test pumping

4.7 Pumping Facilities

4.7.1 General

Requirements for pumping facilities are presented in this section. Pumping facilities shall be designed by an Nevada licensed engineer with specific related experience in design and construction of pumping facilities. Facility designs shall consider and make provisions for long-term operation and maintenance.

4.7.2 Well Pumps

Well pumps shall be either vertical turbine or submersible pumps. The selection of the type of pump to be used shall depend on the size of the motor, length of the pump column, and other considerations. In general, a submersible pump shall not be used when the motor is over 100 horsepower. Submersible pump facilities shall be equipped with a foot valve and pitless unit. Wells with submersible pumps may be located outside of the pumping facility building. Wells with vertical turbine pumps shall be located inside the pumping facility building. Wells equipped with vertical turbine pumps shall be equipped with a water lubricated shaft and anti-reverse ratchet. Water-lubricated pumps shall be equipped with automatic pre-lube provisions. Pumps shall be constructed in accordance with AWWA C101 Standard for Vertical Turbine Pumps-Line Shaft and Submersible Types.

The pump capacity (discharge and total dynamic head) shall be matched with actual operating conditions. The water system improvement plans shall identify the following operating conditions and performance criteria:

1. Casing Diameter
2. Depth of Well
3. Static Water Level
4. Pumping Level
5. Pump Intake Setting
6. Required Pump Discharge
7. Total Dynamic Head at Required Discharge
8. Maximum Pump Speed (Revolutions per Minute)
9. Minimum Motor Horsepower
10. Minimum Efficiency

4.7.3 Booster Pumps

Booster pumps shall be the centrifugal type. The improvement plans shall state the following operating conditions and performance criteria:

1. Required Pump Discharge
2. Total Dynamic Head at Required Discharge
3. Maximum Pump Speed
4. Minimum Motor Horsepower
5. Minimum Efficiency

Booster pumps shall be used to move water from a lower pressure zone to a higher pressure zone. Closed loop pumping shall not be allowed. Fire demand shall be provided from storage.

4.7.4 Mechanical Requirements

All pumping facilities shall have sufficient surge control to protect piping and other equipment. Pressure fluctuations shall be maintained within 15 percent of normal operating pressures during pump starting and stopping. Adequate provisions shall be made for pressure surges caused by power outages. All pumping facilities shall be equipped with pressure relief valves. In addition, all pumps shall be equipped with reduced voltage soft starters

All County and publicly owned facilities shall be provided with 480 volt a. c., three phase power; an engineering analysis shall be provided with all requests for an exemption to three phase power.

All pumping facilities shall be equipped with provisions for pumping water to waste, including adequate drainage and easements. The facilities shall also have a discharge meter and pressure gauge. The discharge meter shall be a Siemens Mag Flow 5100W and have a 4-20 milli-amp output and indicate total flow and rate of flow. The pressure transmitter shall be a Foxboro electronic pressure transmitter with a 4-20 milli-amp output. The discharge meter and pressure gauge shall be suitable for remote reading and shall transmit by telemetry to a location designated by the Public Works Department. Control panels shall be equipped with start counters and hour meters for all pumps. Lightning protection and transient voltage surge suppression devices shall be provided on all phases of commercial power.

Pumping facilities shall include adequate flanged isolation valves and couplings to allow for maintenance and removal of valves, meters, and other equipment. All valves shall have a rising stem or position indicator.

Adequate clear space for access, maintenance and removal and replacement shall be provided around all piping and equipment. At a minimum there shall be 18 inches clear between all piping and equipment and all obstructions.

4.7.5 Chlorination

All well pumping facilities shall be equipped with hypochlorination systems including a minimum 35 gallon container of hypochlorite solution and solution feed pump with wall mounted shelf. The chlorine tank shall have a minimum capacity of 7 days. For County facilities, the feed pumps shall be diaphragm pumps with degassing heads, adjustable stroke and speed, and a minimum turndown ration of 100:1. All of the system components shall be according to the manufacturer's recommendations to insure efficient chlorination system operation. Analyzers, chart recorders, and drum trucks for hypochlorite solution drums shall be provided. Sample taps shall be provided for both treated and untreated water. A stainless

steel (no plastic heads or bowls) emergency eye wash station and shower and appropriate signs shall also be provided.

The chlorination solution tank and pump shall be located in a separate room with an exhaust fan and be isolated from the rest of the pumping facility. The design of the room shall comply with the applicable requirements of the International Building Code, and the Uniform Plumbing Code.

If water quality analysis indicates that chlorination is not adequate to comply with State drinking water requirements, the developer shall evaluate and propose appropriate treatment processes.

4.7.6 Buildings

All pumps, booster pumps, mechanical equipment, chlorination facilities, control equipment, electrical equipment and telemetry equipment shall be enclosed in a building. Buildings shall be masonry block with concrete floor and foundation. The building shall be equipped with locking steel doors. Buildings and pumping stations shall be elevated to a minimum of three feet above the elevation of a flood with a 100-year frequency, or protected to such elevation.

Where pumps are located within a pump building, adequate provisions shall be made for removal and replacement of the motor, column and pump. These provisions may include locating the pump within 4 feet of the wall with a 4 foot by 4 foot (4' x 4') hatch for removal of the assembly or providing removable roof and wall sections.

Suitable ventilation shall be required. Fans shall be thermostatically controlled. Fans and louvers shall be provided with winter covers.

The building shall be provided with suitable heaters to keep the interior air temperature above 45 degrees, emergency lighting, fire extinguisher, and storage cabinets.

Floor drains shall be provided, except in the chlorine room. The building floor shall slope to the drains.

All well pumping facilities shall be fenced with a minimum 6 foot high fence which complies with the Douglas County Development Code. The site access, size and layout shall provide adequate room for maintenance of the facility, including removal of well pumps. For removal of well pumps, there shall be adequate room for the removal equipment and stem trailer.

The exterior noise level at the property line of the well site shall not exceed 65 CNE exterior. Refer to Chapter 20.690 in Title 20 if noise levels exceed 65 CNE exterior.

A design review of the building and building permit are required. A zone change to a public facility zone and a request for a parcel map waiver may also be required if the parcel is not zoned for public use. The building site shall be landscaped and provided with an irrigation system with automatic controls. The irrigation system shall have backflow prevention and shall have automatic drains to prevent freezing, and shall comply with the requirements of Section 2.2.11.3 Permanent Erosion Control Standards. Access to the building site shall be provided by temporary maintenance access in accordance with the requirements of Section 3.10.14 Improved Maintenance Access. Permanent maintenance access in accordance with the requirements of Section 3.10.14 Improved Maintenance Access may be required by the County or utility purveyor.

4.7.7 Stand-by Generator

A stand-by engine generator shall be provided with automatic starting and load transfer equipment to operate the entire pumping load during power failure unless primary power is provided by connecting to at least two independent public power sources. The generator shall be fueled by diesel or by natural gas as approved by the County and utility purveyor. The storage tank shall have a capacity to provide a 24-hour continuous run time. Generators for County facilities shall be manufactured by Cummins Power Generation. Generators shall be provided with the following:

1. Weather-protective with silencer (NEMA Type 4), sound proofed (QuietSite Level 2 enclosure with silencer), vandal-proof and lockable housing with access to all engine and generator components
2. Above ground vandal-proof double walled storage tank, and concrete pad for secondary containment
3. Engine block heater and thermostat to allow for instantaneous start-up at –30 degrees Fahrenheit
4. Shutdown safeguards, gauges and indicator lamps for over temperature, low oil pressure, overspeed and overcrank
5. Automatic battery charger installed on the hot side of the transfer switch enabling the batter to maintain its charge when idle
6. Walkway platform and safety guards for generators larger than 75 kilowatt to provide maintenance access to engine compartment
7. Power command digital display generator set control for generator set monitoring, metering, and control system which includes Level 2 Control, front panel security key, digital display, network communications module, load monitoring module and relay module
8. Cummins Power Generation OTPC Power Command Automatic Transfer Switch to monitor the primary source, signal generator set startup, automatically transfer power, and return the load to primary power source once the power utility returns and is stabilized

The generator site shall be fenced with a minimum six (6) foot high fence which complies with the Douglas County Development Code. Access shall be through a sixteen (16) foot wide double gate. The generator site shall be landscaped and provided with an irrigation system with automatic controls. The irrigation system shall have backflow prevention and shall have automatic drains to prevent freezing, and shall comply with the requirements of Section 2.2.11.3 Permanent Erosion Control Standards. Access to the generator site shall be provided by temporary maintenance access in accordance with the requirements of Section 3.10.14 Improved Maintenance Access. Permanent maintenance access in accordance with the requirements of Section 3.10.14 Improved Maintenance Access may be required by the County or utility purveyor.

4.8 Water Storage Tanks

4.8.1 General

Water storage facilities shall be provided for all water systems. Where only one phase of a subdivision is being built, the storage facilities shall be sized and initially constructed for the entire subdivision to reduce the possibility of multiple smaller tanks. A design review of the storage tank and a building permit will be required.

4.8.2 Design Criteria

Water storage facilities shall comply NAC 445A and with the following design criteria:

1. Required storage capacity for existing water systems shall be determined by an engineer on the basis of historic data, engineering judgment, and network hydraulic modeling, correlating total water system capacity with present and anticipated demands, while maintaining minimum pressures of Section 4.1.1.
2. Booster station capacity and the total storage requirement for each pressure zone within the distribution system shall meet the maximum day requirements of that particular pressure zone. Water storage may be provided in a higher pressure zone, if an appropriate pressure regulator is installed between the zones, to serve the lower pressure area, and the requirements for the higher pressure zone are not compromised.
3. Alternative pumping capacity shall not be used in lieu of satisfying storage requirements.
4. Storage tanks shall have an overflow, and the overflow shall be sized to pass the maximum possible inflow. The overflow outlet shall be screened or protected with a flap gate and shall have a minimum air gap of 18 inches. The drainage path of water being discharged from the overflow pipe shall be identified on the plans. The drainage channel shall be able to handle maximum possible inflow without damage to the channel or adjacent structures or property. The drainage channel shall be within an easement dedicated to the County and the drainage channel shall be extended to an existing storm drainage facility or storm drain system. Infiltration trenches will not be allowed for disposal of overflow.
5. Storage tanks shall have a drain which shall be capable of completely draining the tank. The tank drain shall direct water to the overflow channel. The route of the overflow shall be reviewed to determine that the overflow route has the capacity to transmit the maximum overflow amount. The inlet of the tank shall be located as far as possible from the outlet to allow the maximum mixing of water.
6. Storage tanks shall be located on a site which is large enough to accommodate a second tank of the same size as the proposed storage tank.
7. An in tank mixing system is required if the theoretical water age exceeds 5 days based on average day demands. For chlorinated systems the in tank mixing system is to be equipped with liquid chlorine injection system and necessary appurtenances to make the injection system operational.

4.8.3 Materials

All above ground water storage tanks smaller than 500,000 gallons shall be welded steel tanks (AWWA D100). Tanks 500,000 gallons or larger shall be either welded steel (AWWA D100) or prestressed concrete (AWWA D110 Type I or III). All underground, buried, or partially buried tanks will be prestressed concrete (AWWA D110 Type I or III). Used tanks, bolted steel tanks, American Petroleum Institute (API) steel tanks, wood tanks, thermosetting fiberglass reinforced plastic tanks, and tanks with flexible membrane liners will not be allowed.

A life-cycle costs analysis (LCCA) will be completed on all tanks larger than 500,000 gallons. The LCCA shall follow the methods outlined in 10 CFR 436A and ASTM E917. The LCCA shall consider a 60 year usable life and at minimum three tank rehabilitations project over 60 years. Determination if the tank will be constructed using welded steel or concrete will be decided by the results of the LCCA. A copy of the LCCA will be provided to Douglas County for review prior to approval of the tank material.

Steel tank bottoms shall have a minimum thickness of 5/16 of an inch and shall be constructed on neutral pH environment under the tank

For all steel tanks, a corrosion specialist shall evaluate the water chemistry and provide a written report and recommendations for a cathodic protection system. If cathodic protection is recommended, the cathodic protection system shall be an automatically controlled, impressed-current system which meets the requirements of AWWA D104 Automatically Controlled, Impressed-Current Cathodic Protection for the Interior of Steel Water Tanks. A long-life anode system shall be provided.

4.8.4 Appurtenances

All water storage tanks shall have the following appurtenances:

1. Shell Manholes (30 inch diameter minimum) - 2 each (approximately 2 feet above the base of the tank), except for buried tanks
2. Overflow Structure and Pipe
3. Outside Ladder with cage
4. Inside Ladder
5. Outside Level Indicator (all County facilities except those located in the Lake Tahoe Basin)
6. Safety Devices - ladder safety cage, rest platforms, handrails or other safety devices as required
7. Ladder Locking Device - prevents unauthorized access to the outside ladder
8. Roof Openings - at least one bug proof and lockable water tight hatch at the access point for the inside ladder
9. Vents - three each, "J" type with screens, two at edge and one at center of tank. Vents shall be designed and sized to prevent external pressure from causing the tank to buckle, and prevent the entrance of rain and surface water; and exclude dust, birds, insects and other animals as much as possible. Refer to NAC 445A.6708 and AWWA D100 Section 7.5.
10. Appropriate water level sensing and telemetering equipment
11. Bolted flange gate valve to isolate tank from distribution system
12. Sample tap with insulated, locking cover
13. Intrusion alarm on roof openings, connected to telemetry system
14. If required (based on theoretical water age), in tank mixing systems.

    a. Passive systems (using engineered inlet and outlet valving that does not require a power source such as the Tideflex system) are preferred if sufficient inlet/outlet demands are sufficient to provide mixing. A mixing analysis is required, either performed by the equipment manufacturer or design engineer, for County review and approval that demonstrates that the passive system will provide adequate mixing.

    b. Active system (low horsepower electric motor driven system) can be used if a passive system is not capable of providing adequate mixing. A mixing analysis is required, either

performed by the equipment manufacturer or design engineer, for County review and approval that demonstrates that the passive system will provide adequate mixing.

4.8.5 Painting

Proper protection shall be given to all metal surfaces by paints or other coatings. Interior painting system shall be a three coat, two component epoxy system in accordance with AWWA D102 Coating Steel Water-Storage Tanks System Designation ICS-2-W. The interior finish coat color shall be white. The exterior painting system shall be a three coat epoxy and polyurethane painting system in accordance with AWWA D102 Coating Steel Water-Storage Tanks System Designation OCS-5-C. Final outside color may be set by the Douglas County Design Review, or the Douglas County Public Works Department.

Paints or other coatings shall conform to AWWA D102 Coating Steel Water-Storage Tanks and NSF International Standard 61. All internal coatings shall be certified for contact with potable water. Testing for this certification shall be conducted in accordance with NSF International Standard 61 or by a third party certifications laboratory accredited by ANSI.

4.8.6 Site Work

A geotechnical investigation and foundation design shall be prepared for all tank sites. The tank site shall be graded to provide suitable soil stability and drainage. The tank foundation shall be placed entirely on cut when practical. There shall be access to all sides of the tank on a graveled (Type 2, Class B aggregate base) road, minimum width of 15 feet, circling the tank. The site shall be fenced with a minimum 6 foot high fence which complies with the Douglas County Development Code. Access shall be through a 16 foot wide double gate.

The tank site shall be landscaped and provided with an irrigation system with automatic controls. The irrigation system shall have backflow prevention and shall have automatic drains to prevent freezing, and shall comply with the requirements of Section 2.2.11.3 Permanent Erosion Control Standards. Access to the tank site shall be provided by temporary maintenance access in accordance with the requirements of Section 3.10.14 Improved Maintenance Access. Permanent maintenance access in accordance with the requirements of Section 3.10.14 Improved Maintenance Access may be required by the County or utility purveyor.

4.8.7 Inspection and Testing

All tanks shall be tested and inspected in accordance with AWWA D100 Standard for Welded Steel Tanks for Water Storage. A coatings inspector that is certified by NACE International shall inspect interior and exterior coatings. All field welds shall be inspected by the radiographic method by an independent testing agency. The Engineer of Record shall submit a written report, including x-ray film, in accordance with AWWA D100 Standard for Welded Steel Tanks for Water Storage to the Engineering Division.

Upon completion of all construction work and tank coatings, and in conjunction with the disinfection procedure, the tank shall be completely filled with water and allowed to sit for a period of 72 hours with no leakage. Water level measurements shall be taken at the start of the leakage testing and every 24 hours thereafter until complete.

The developer shall warranty the completed work against repairs, leaks or damage for a period of one year from the acceptance of the work by the County. Eleven months after acceptance of the work by the County, the developer shall have the interior and exterior of the tank inspected by an independent testing agency and provide a written report to the County in accordance with AWWA D102 Coating Steel Water-

Storage Tanks. Damage, leaks, or other deficiencies noted during the inspection shall be corrected by the developer.

4.8.8 Disinfection and Volatile Organic Compound Sampling and Testing

All tanks shall be disinfected and tested in accordance with AWWA C652 Standard for Disinfection of Water-Storage Facilities and the applicable State Health standards. After disinfection, prior to acceptance by the utility purveyor, and prior to placing the tank into service, water from the facility shall be tested for coliform and volatile organic compounds by an independent testing agency. The test procedures and test results shall comply with the requirements of the Nevada Division of Environmental Protection Bureau of Safe Drinking Water and other appropriate regulatory agencies. Written test results shall be submitted to the County a minimum of two working days before placing the tank into service.

4.9 Treatment Facilities

Treatment facility design, capacity, and reliability shall comply with the requirements of NAC 445A. The location and design of treatment facilities shall consider topography, soil conditions, and potential hazards such as fire, earthquake, and flood. Treatment facility plans and specifications shall be submitted to the Nevada Division of Environmental Protection Bureau of Safe Drinking Water for review and approval. Following written approval of the treatment facility by the Nevada Division of Environmental Protection Bureau of Safe Drinking Water, plans and specifications shall be submitted to the Engineering Division and Public Works Department for review and approval.

4.10 Controls and Alarms

Control systems, including telemetry shall be above surface grade in suitable lockable and vandal-proof housings, or inside buildings. Telemetry shall be provided for all controls and alarms. All telemetry units shall communicate status with the water purveyor's central computer at a location designated by the water purveyor. At a minimum, the following alarms and signals shall be provided:

Water Storage Tanks:

1. High Level Alarm
2. Redundant Float High Level Alarm
3. Low Level Alarm
4. Radio Failure Alarm
5. Power Failure Alarm
6. Intruder Alarm (roof and manways)
7. Radio Telemetry Unit (RTU) Intruder Alarm

Water Supply Wells:

1. Well Pump Running
2. High Pressure Alarm
3. Primary Power Failure Alarm
4. Intruder Alarm (wellhead, hatches, building doors)
5. Radio Failure Alarm
6. Generator Start/Running

7. Generator Fail to Start
8. High and Low Chlorine Level Alarm

Booster Pump Facilities:

1. Pump Running
2. Generator Start/Running
3. Generator Fail to Start
4. Radio Failure Alarm
5. Primary Power Failure Alarm
6. High Pressure Alarm
7. Intruder Alarm (building doors and hatches)
8. High and Low Chlorine Level Alarm

4.11 Springs

Springs shall not be allowed as a source of water for public water systems.

4.12 Record Drawings

Record drawings shall be submitted to the Engineering Division prior to acceptance of facilities or improvements. Record drawings shall comply with the requirements of Section 2.2.19 Record Drawings.

4.13 Operations and Maintenance Manual

Four copies of an operations and maintenance manual shall be submitted to the Engineering Division and Public Works Department upon completion of construction and prior to acceptance of facilities or improvements, including transmission and distribution mains, wells and water storage tanks. The operations and maintenance manual shall comply with the requirements of NAC 445A.6667 and contain the following as a minimum:

1. Listing of emergency telephone numbers for utility purveyor
2. Priority calling list
3. List of abbreviations
4. General narrative of the facility
    a. Introduction
    b. Objectives of the facility
    c. Facility design criteria
5. Operating instructions
    a. Facility description
    b. Emergency operation (discussion of potential facility failures and procedures for responding to emergency operations)
6. Operating records
7. Monitoring and treatment processes

8. Maintenance instructions
    a. General instructions
    b. Maintenance records
    c. Maintenance of motors and drives
    d. Maintenance of pumps
    e. Maintenance of treatment/process equipment
    f. Maintenance of valves
    g. Maintenance of instrumentation and meters
9. Facility safety
    a. General
    b. Confined spaces
    c. Electrical safety
    d. Explosion hazards
    e. Process facilities
    f. Pump rooms
    g. Collecting samples
    h. Equipment set-up and performance tests
    i. General safety considerations
10. Appendices as required
    a. Permits
    b. Figures and drawings

4.14 Facility Start-Up

The developer shall commission all systems including wells, pumps, tanks, and equipment to verify performance, function, and correct operation by performing procedures to activate, startup, adjust, test, and demonstrate the system in operating order in accordance with the approved plans and specifications and inspection and test requirements of the utility purveyor. To insure that the work is ready for full-time operation, the developer shall include procedures for the verification, balancing, calibration, witness testing, documentation, and inspection by equipment manufacturers. The developer shall also provide training of utility operators. Facility start-up and operator training shall be completed prior to acceptance by the utility purveyor.

Start-up shall be conducted as follows:

1. The Engineering Division and Public Works Department shall be notified in writing 45 days before complete facility operation is to occur. The developer shall start-up and operate the facility on a complete full time basis beginning on the indicated date. The developer shall provide a mechanic, electrician, instrument engineer, representatives of manufacturers of equipment, and other personnel to adjust, repair, and correct

deficiencies during start-up. The developer shall conduct all tests and inspections required by the utility purveyor.

2. Following start-up, the utility purveyor will take over operation and maintenance duties.

3. The developer or their representative shall submit documentation of test reports and calibration results to the Engineering Division and Public Works Department during start-up.

4. Prior to start-up, the developer shall submit to the utility purveyor affidavits stating that the equipment has been properly installed, tested, and adjusted. The affidavit shall contain the following wording:

   "The (Name of Equipment) has been properly installed, tested, adjusted, lubricated, and calibrated, and is ready for full time operation. The installation has been inspected and been found to be in accordance with our (the manufacturer's) standards and requirements."

5. The developer shall provide training to utility operators which shall include a demonstration of the operation, maintenance, and safety procedures for all facilities. Training shall not be conducted during start-up.

4.15 Posting Security for Tanks, Wells, and Booster Stations

The developer shall post a deposit or letter of credit on a form acceptable to the County in the amount of $25,000 with the County before the County will issue a notice of completion for the water tank, well, and/or booster station. The County will hold this deposit or letter of credit until the developer completes the eleven month inspection and corrective work. If the developer does not conduct the inspection at eleven months or does not correct damage, leaks or other deficiencies noted during the inspection, the County may use the deposit or letter of credit to complete this work.

4.15 References

1. "AWWA A100 Standard for Water Wells," American Water Work Association, Denver, Colorado.
2. "AWWA D102 Standard for Coating Steel Water-Storage Tanks," American Water Work Association, Denver, Colorado.
3. "ANSI/AWWA C 105/ A21.5-05American National Standard for Polyethylene Encasement for Ductile Iron Piping for Water and Other Liquids," American Water Work Association, Denver, Colorado.
4. "AWWA C150/A21.50 American National Standard for the thickness Design of Ductile Iron Pipe," American Water Work Association, Denver, Colorado.
5. "AWWA C151/A21.51 American Nation Standard for Ductile Iron Pipe, Centrifugally Cast in Metal Molds or Sand-Lined Molds, for Water or Other Liquids," American Water Work Association, Denver, Colorado.
6. "AWWA C504 Standard for Rubber Seated Butterfly Valves," American Water Work Association, Denver, Colorado.
7. "AWWA C506 Standard for Backflow Prevention Devices - Reduced Pressure Principle and Double Check Valve Types," American Water Work Association, Denver, Colorado.
8. "AWWA C509 Standard for Resilient-Seated Gate Valves, for Water and Sewerage Systems," American Water Work Association, Denver, Colorado.
9. "AWWA C651 Standard for Disinfecting Water Mains," American Water Work Association, Denver, Colorado.
10. "AWWA C652 Standard for Disinfection of Water-Storage," American Water Work Association, Denver, Colorado.
11. Hydraulic Institute Standards, Hydraulic Institute, 9 Sylvan Way, Parsippany, New Jersey 07054-3802.
12. "Nevada Administrative Code Chapter 445 A - Public Water System Design, Construction, Operation and Maintenance," Division of Health, Bureau of Health Protection Services, Carson City, Nevada.
13. "Recommended Standards for Water Works," Great Lakes Upper Mississippi Board of State Public Health and Environmental Managers.
14. "Standard Specifications for Public Works Construction," Regional Transportation Commission of Washoe County, Washoe County, City of Sparks, City of Reno, Carson City, City of Yerington.
15. State of Nevada Division of Water Resources, Regulations for Drilling Water Wells.

Table 4.2. Water System Improvement Checklist.

1. Water System Model and Report

_____proposed water system

_____impacts on existing facilities

_____drawings and maps to illustrate the water system

_____listing of all assumptions

_____appendices with detailed results of analyses

_____recommendations for type, size, location, and phasing of water system improvements

_____any other data that may be required to present the results of the water system analyses

_____tabulation of water system pressures for all simulations and pressure contour maps for all simulations

_____extended period and fire flow simulations for the proposed system and the ultimate system at master plan build-out for the maximum allowable densities in the most critical areas of the system

2. Water System Improvement Plans

final wet stamped construction drawings, specifications, design calculations, and cost estimates for:

_____water mains (include plan and profile, stationing, topography, all existing features and work to be performed, etc.)

_____wells

_____pumping facilities

_____treatment facilities

_____storage tanks

_____buildings

_____appurtenant facilities

3. Water Rights

water rights of an acceptable quantity, form, and character including:

_____recorded quitclaim deed

_____conveyance of Title Report

_____Change Application as required

4. Permits, Easements and Agency Approvals

_____recorded easements for all improvements as shown on the drawings

_____final permits from all agencies

_____NDEP Bureau of Safe Drinking Water written approval

Table 4.2. Water System Improvement Checklist (Continued).

5. Water Supply Wells

_____Hydrogeologic Evaluation which includes:

- _____a detailed map showing well location
- _____a summary of available hydrogeologic information including reports, logs of nearby wells, water quality data, and any other relevant information
- _____a description of the proposed plan for exploration, testing and well construction
- _____a statement of anticipated water demand from the well
- _____recommendations for well construction, drilling, test pumping, and water sampling and analysis

_____Well Design Report which includes:

- _____daily drillers logs and inspectors daily reports
- _____lithologic logging and sampling logs
- _____temperature, resistivity, specific conductance logs
- _____well cross section
- _____maximum day demand
- _____average day demand
- _____water quality sampling and testing
- _____casing material
- _____well screen
- _____gravel pack design
- _____drilling method
- _____plumbness and alignment tests
- _____test pumping program and results (yield and efficiency testing)
- _____development
- _____disinfection program

_____final wet stamped construction drawings, specifications, and design calculations for the well and appurtenant facilities

6. Pumping Facilities

_____well pump design criteria, construction drawings, and specifications including:

- _____casing diameter
- _____depth of well
- _____sanitary seal
- _____static water level
- _____pumping level

Table 4.2. Water System Improvement Checklist (Continued).

_____pump intake setting
_____required pump discharge
_____total dynamic head at required discharge
_____maximum pump speed (revolutions per minute)
_____minimum motor horsepower
_____minimum efficiency
_____plan and section drawings
_____piping drawings and details
_____projection of capital and operation and maintenance costs

_____booster pump design criteria, construction drawings, and specifications including:
_____type of pumps (end suction, split cased, can, etc.)
_____required pump discharge
_____total dynamic head at required discharge
_____maximum pump speed
_____minimum motor horsepower
_____minimum efficiency
_____plan and section drawings
_____piping drawings and details

_____chlorination facility design, drawings, and specifications

_____building design and drawing, and specifications

_____stand-by generator design and specifications

_____electrical diagrams, schematics, drawings, and specifications for all facilities

_____final wet stamped construction drawings, specifications, cost estimates, and design calculations for all well pumps, booster pumps, chlorination facilities, buildings, and stand-by generators

7. Water Storage Tanks

_____design report
_____geotechnical investigation and foundation design
_____water system model and sizing analysis
_____fire flow requirements
_____average day and peak day requirements
_____equalization requirements

Table 4.2. Water System Improvement Checklist (Continued).

_____emergency storage

_____final wet stamped construction drawings, specifications, and design calculations

8. Annual Operation and Maintenance Costs

_____water distribution system

_____wells and pump stations

_____storage tanks

_____telemetry and controls

9. Operation and Maintenance Manual

_____water distribution system

_____wells and pump stations

_____storage tanks

_____telemetry and controls